1. Two capillaries made of same material but of different radii are dipped in a liquid. The rise of liquid in one capillary is 2.2cm and that in the other is 6.6cm. The ratio of their radii is
(a) 9 : 1 (b) 1 : 9 (c) 3 : 1 (d) 1 : 3

2. The surface tension of a liquid is 5 N/m. If a film is held on a ring of area 0.02 m^2, its total surface energy is about -
(a) 5×10^{-2} J (b) 2.5×10^{-2} J
(c) 2×10^{-1} J (d) 3×10^{-1} J

3. In a U-tube the radii of two columns are respectively r_1 and r_2. When a liquid of density ρ ($\theta = 0^o$) is filled in it, a level difference of h is observed on two arms, then the surface tension of the liquid is -
(a) $\frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$ (b) $h\rho g (r_2 - r_1)$
(c) $\frac{h\rho g(r_2 - r_1)}{2}$ (d) $\frac{h\rho g}{2(r_2 - r_1)}$

4. Neglecting gravity, the potential energy of a molecule of liquid on the surface of liquid as compared to a molecule inside liquid is :
(a) greater
(b) less
(c) equal
(d) depending on the liquid sometimes more, sometimes less

5. A thin wire is bent in the form of a ring of diameter 3.0 cm. The ring is placed horizontally on the surface of soap solution and then raised up slowly. Upward force necessary to break the film formed between the ring and the solution is –
(a) $6\pi T$ dyne (b) $2\pi T$ dyne
(c) $4\pi T$ dyne (d) $3\pi T$ dyne

6. When a cylindrical tube is dipped vertically into a liquid, the angle of contact is 140^0. When the tube is dipped with an inclination of 40^0, then the angle of contact is :
(a) 100^0 (b) 140^0
(c) 180^0 (d) 60^0

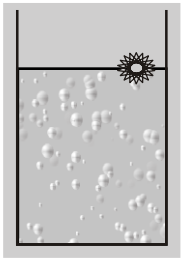
7. Two unequal soap bubbles are formed one on each side of a tube closed in the middle by a tap. What happens when the tap is opened to put the two bubbles in communication ?
(a) No air passes in any direction as the pressure are the same on two sides of the tap
(b) Larger bubble shrinks and smaller bubble increases in size till they become equal in size
(c) Smaller bubble gradually collapses and the bigger one increases in size
(d) None of the above

8. It is easy to wash clothes in hot water because is :
(a) Surface tension is more
(b) Surface tension is less
(c) Consumes less soap
(d) Floating forces come in to play

9. A soap bubble in vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4 cm. If the two bubbles coalesce under isothermal conditions then the radius of the new bubble is :

(a) 2.3 cm (b) 4.5 cm
(c) 5 cm (d) 7 cm

10. A body floats in liquid contained in a beaker. If the whole system (shown in fig.) falls under gravity then the up-thrust on the body is-



(a) 2 mg (b) zero
(c) mg (d) less than mg

11. A rectangular film of liquid is extended from (4 cm × 2cm) to (5 cm × 4 cm). If the work done is 3×10^{-4} J, the value of the surface tension of the liquid i
(a) 8.0 Nm^{-1} (b) 0.250 N m^{-1}
(c)0.125 Nm^{-1} (d) 0.2 Nm^{-1}

12. Assume that a drop of liquid evaporates by decreasing in its surface energy, so that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible ? The surface tension is T, density of liquid is ρ and L is its latent heat of vaporization. (a) ρL/T (b) $\sqrt{T/\rho L}$
(c) T/ρL (d) 2T/ρL

13. Water rises upto a height *h* in a capillary on the surface of earth in stationary condition. Value of h increases if this tube is taken
(a) On sun
(b) On poles
(c) In a lift going upward with acceleration
(d) In a lift going downward with acceleration

14. A shell having a hole of radius *r* is dipped in water. It holds the water upto a depth of *h* then the value of *r* is
(a) $r = \frac{2T}{hdg}$ (b) $r = \frac{T}{hdg}$
(c) $r = \frac{Tg}{hd}$ (d) None of these

15. If liquid level falls in a capillary then radius of capillary will
(a) Increase (b) Decrease
(c) Unchanged (d) None of these

16. Water rises in a vertical capillary tube upto a height of 2.0 *cm* . If the tube is inclined at an angle of 60^o with the vertical, then upto what length the water will rise in the tube
(a) 2.0 *cm* (b) 4.0 *cm*
(c) $\frac{4}{\sqrt{3}} cm$ (d) $2\sqrt{2}\, cm$

17. In a capillary tube experiment, a vertical 30 *cm* long capillary tube is dipped in water. The water rises up to a height of 10*cm* due to capillary action. If this experiment is conducted in a freely falling elevator, the length of the water column becomes
(a) 10 *cm* (b) 20 *cm*
(c) 30 *cm* (d) Zero

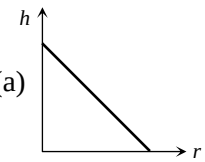
18. In a capillary tube, water rises to 3 *mm*. The height of water that will rise in another capillary tube having one-third radius of the first is
(a) 1 *mm* (b) 3 *mm*
(c) 6 *mm* (d) 9 *mm*

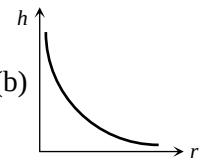
19. Kerosene oil rises up the wick in a lantern
(a) Due to surface tension of the oil
(b) The wick attracts the kerosene oil
(c) Of the diffusion of the oil through the wick
(d) None of the above

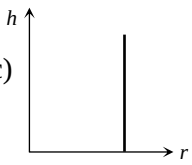
20. There is a horizontal film of soap solution. On it a thread is placed in the form of a loop. The film is pierced inside the loop and the thread becomes a circular loop of radius *R*. If the surface tension of the loop be *T*, then what will be the tension in the thread
(a) $\pi R^2 / T$ (b) $\pi R^2 T$
(c) $2\pi RT$ (d) $2RT$

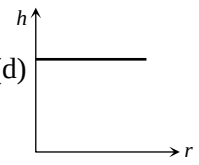
21. In a surface tension experiment with a capillary tube water rises upto 0.1 *m*. If the same experiment is repeated on an artificial satellite, which is revolving around the earth, water will rise in the capillary tube upto a height of
(a) 0.1 *m*
(b) 0.2 *m*
(c) 0.98 *m*
(d) Full length of the capillary tube

22. The correct curve between the height or depression *h* of liquid in a capillary tube and its radius is

(a) 

(b) 

(c) 

(d) 

23. A soap film of surface tension $3 \times 10^{-2}\ Nm^{-1}$ formed in rectangular frame, can support a straw. The length of the film is 10 *cm*. Mass of the straw the film can support is
(a) 0.06 *gm* (b) 0.6 *gm*
(c) 6 *gm* (d) 60 *gm*

24. Energy required to form a soap bubble of diameter 20 *cm* will be (Surface tension for soap solution is 30 *dynes*/*cm*)
(a) 12000 π *ergs* (b) 1200 π *ergs*

(c) 2400 π *ergs* (d) 24000 π *ergs*

25. When a capillary tube is dipped in water it rises upto 8 *cm* in the tube. What happens when the tube is pushed down such that its end is only 5 *cm* above the outside water level

(a) The radius of the meniscus increases and therefore water does not overflow

(b) The radius of the meniscus decreases and therefore water does not overflow

(c) The water forms a droplet on top of the tube but does not overflow

(d) The water start overflowing

26. A bubble of 8 mm diameter is formed in the air. The surface tension of soap solution is 30 *dynes*/*cm*. The excess pressure inside the bubble is

(a) 150 *dynes*/*cm*^{2} (b) 300 *dynes*/*cm*^{2}

(c) 3×10^{-3} *dynes*/*cm*^{2} (d) 12 *dynes*/*cm*^{2}

27. The angle of contact between glass and water is 0^o and it rises in a capillary upto 6 *cm* when its surface tension is 70 *dynes*/*cm*. Another liquid of surface tension 140 *dynes*/*cm*, angle of contact 60^o and relative density 2 will rise in the same capillary by

(a) 12 *cm* (b) 24 *cm*

(c) 3 *cm* (d) 6 *cm*

28. A drop of water breaks into two droplets of equal size. In this process, which of the following statement is correct

(a) The sum of temperature of the two droplets together is equal to the original temperature of the drop

(b) The sum of masses of the two droplets is equal to the original mass of the drop

(c) The sum of the radii of two droplets is equal to the radius of the original drop

(d) The sum of the surface areas of the two droplets is equal to the surface area of the original drop

29. The diameter of rain-drop is 0.02 *cm*. If surface tension of water be 72×10^{-3} *newton* per *metre*, then the pressure difference of external and internal surfaces of the drop will be

(a) 1.44×10^4 *dyne* $- cm^{-2}$

(b) 1.44×10^4 *newton* $- m^{-2}$

(c) 1.44×10^3 *dyne* $- cm^{-2}$

(d) 1.44×10^5 *newton* $- m^{-2}$

30. Water rises to a height of 16.3 *cm* in a capillary of height 18 *cm* above the water level. If the tube is cut at a height of 12 *cm*

(a) Water will come as a fountain from the capillary tube

(b) Water will stay at a height of 12 *cm* in the capillary tube

(c) The height of the water in the capillary will be 10.3 *cm*

(d) Water will flow down the sides of the capillary tube

1. (c)

As $h \propto \frac{1}{r}$ $\therefore \frac{h_1}{h_2} = \frac{r_2}{r_1}$ or $\frac{r_1}{r_2} = \frac{h_2}{h_1} = \frac{6.6}{2.2} = \frac{3}{1}$ SS

2. (c)

Because film has two surface so

$\Delta U = T \times (2A) = 2 \times 10^{-1}$ J

3. (a)

$\rho gh = 2T\left(\frac{1}{r_1} - \frac{1}{r_2}\right) = 2T\left(\frac{r_2 - r_1}{r_1 r_2}\right)$

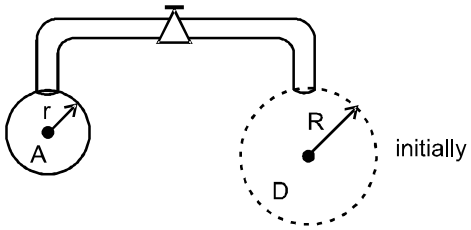
$\therefore T = \frac{\rho g h r_1 r_2}{2(r_2 - r_1)}$

4. (a)Molecule on the surface experiences a net molecular attraction force downwards.

5. (a)$F = 2 \times 2\pi rT = 2 \times \pi dT = 6\pi T$ dyne

6. (b) Remains same angle of contact depends on solid nature of and liquid surface in contact.

7. (c)



$P_A = P_0 + \frac{4T}{r}$; $P_B = P_0 + \frac{4T}{r}$ {P_0 = atmospheric pressure}.

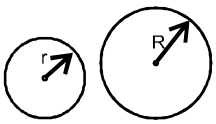
Clearly $P_A > P_B$; so air will flow from A to B.

As r decreases; pressure will become more and hence more flow of air from A to B.

Ultimately bubble A collapses and B becomes bigger in size.

8. (b)

9. (c)



R = 4 cm.

r = 3 cm.

$P_r = \frac{4T}{r}$; $P_R = \frac{4T}{R}$ {$\because$ outside is vaccum

The two bubbles are coalescing; so conserving the no. of molecules inside, T_0 = Temperature.

$$\frac{P_r \cdot \frac{4}{3}\pi r^3}{T_0} + \frac{P_R \cdot \frac{4}{3}\pi R^3}{T_0} = \frac{P_{final} \times \frac{4}{3}\pi (r')^3}{T_0}$$

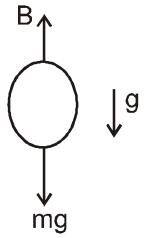
Putting $P_{final} = \frac{4T}{r'}$ we get

r' = $\sqrt{r^2 + R^2}$

= $\sqrt{3^2 + 4^2}$ = 5 cm.

10. (b)Equation of motion mg - B = mg $\Rightarrow$ B = 0

mg - B = mg $\Rightarrow$ B = 0



11. (c)Increase in surface area = (20 cm^2 – 8 cm^2) × 2

= 12 × 2 cm^2

= 24 cm^2 (film has two surfaces)

So work done = T.ΔS = T × 24 × 10^{-4} = 3 × 10^{-4}

so T = $\frac{3}{24}N/m = \frac{1}{8}Nm^{-1}$ = 0.125 N/m

12. (d)When radius is decrease by dr

decrease in surface energy = Heat required for vaporisation

ΔAT = ΔVρL

$\Rightarrow$ 4 × (2πr)dr T = 4πr²drρL $\Rightarrow$ r = $\frac{2T}{\rho L}$

13. (d) If lift moves downward with some acceleration then effective *g* decreases, so *h* increases.

As $h = \frac{2T\cos\theta}{rdg}$ $\therefore h \propto \frac{1}{g}$

14. (a) $\frac{2T}{r} = hdg \Rightarrow r = \frac{2T}{hdg}$

15. (a) $h \propto \frac{1}{r} \therefore rh$ = constant

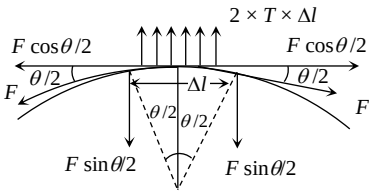
16. (b) $l = \frac{h}{\cos\theta} = \frac{2}{\cos 60^o} = 4.0\ cm$

17. (c) The length of the water column will be equal to full length of capillary tube.

18. (d) $h \propto \frac{1}{r}$

19. (a)

20. (d) Suppose tension in thread is F, then for small part Δl of thread



$\Delta l = R\theta$ and $2F\sin\theta/2 = 2T\Delta l = 2TR\theta$

$\Rightarrow F = \frac{TR\theta}{\sin\theta/2} = \frac{TR\theta}{\theta/2} = 2TR(\sin\theta/2 \approx \theta/2)$

21. (d) In the satellite, the weight of the liquid column is zero. So the liquid will rise up to the top of the tube.

22. (b) $h = \frac{2T\cos\theta}{rdg} \therefore\ h \propto \frac{1}{r}$. So the graph between h and r will be rectangular hyperbola.

23. (b) The weight of straw will be balanced by the force of surface tension $\therefore\ mg = 2Tl \Rightarrow m = \frac{2Tl}{g}$

$= \frac{2\times3\times10^{-2}\times10\times10^{-2}}{9.8} kg = 0.6gm$

24. (d) $E = 8\pi r^2 T = 8\pi(10)^2 \times 30 = 24000\ \pi\ erg$

25. (a) $h = \frac{2T}{Rdg} \Rightarrow hR = \frac{2T}{dg} = \text{constant}$

When h decreases, R increases.

26. (b) $\Delta P = \frac{4T}{r} = \frac{4\times30}{0.4} = 300\ dyne/cm^2$.

27. (c) $h = \frac{2T\cos\theta}{rdg} \therefore\ \frac{h_2}{h_1} = \frac{T_2}{T_1}\times\frac{\cos\theta_2}{\cos\theta_1}\times\frac{d_1}{d_2}\times\frac{r_1}{r_2}$

$\frac{h_2}{h_1} = \frac{140}{70}\times\frac{\cos60°}{\cos0°}\times\frac{1}{2}\times1 = \frac{1}{2} \Rightarrow h_2 = \frac{h_1}{2} = 3cm.$

28. (b)

29. (a) $\Delta P = \frac{2T}{r} = \frac{2\times72\times10^{-3}}{0.01\times10^{-2}} = 1440\ N/m^2$

$= 1.44\times10^4\ dyne/cm^2$

30. (b) Because if the length available is less than required, then water will rise upto available height and adjust its radius of curvature.